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## Exploring the Odonata diversity in the Chaco ecoregion (Northern Argentina)

Carlos Molineri<sup>1\*</sup>, Javier Márquez<sup>2</sup>, José Rodríguez<sup>1</sup>,  
Daniel Emmerich<sup>1,3</sup> & Federico Lozano<sup>4</sup>

<sup>1</sup>Instituto de Biodiversidad Neotropical. Tucumán, Argentina

<sup>2</sup>Departamento de Ciencias Naturales, Universidad Nacional de  
Río Cuarto. Córdoba, Argentina.

<sup>3</sup>Escuela Normal Superior D. V. Sarsfield. Córdoba, Argentina

<sup>4</sup>Laboratorio de Biodiversidad y Genética Ambiental (BioGeA), Universidad Nacional  
de Avellaneda, Piñeyro, Argentina

\*Email: carlosmolineri@gmail.com

### Abstract

During 2021 and 2022, 33 localities mostly in the Dry Chaco ecoregion from Argentina were assessed for Odonata diversity. We registered 84 species, about 29% of the total richness known for Argentina. We reared 14 species from larva to adult, two of which are still unknown at the larval stage (*Progomphus aberrans* Belle and *P. kimminsi* Belle). We also report 13 new provincial records: *Orthemis aequilibris* Calvert, *Brachymesia furcata* (Hagen, 1861), and *Neoneura confundens* Wasscher & van't Bosch for Formosa province; *Rhionaeschna planaltica* (Calvert), *Erythemis plebeja* (Burmeister), *Erythrodiplax nigricans* (Rambur, 1842) and *Progomphus aberrans* Belle for San Luis province; *Planiplax erythropyga* (Karsch 1891), *Homeoura chelifera* (Selys, 1876) and *Oxyagrion brevistigma* Selys, 1876 for Córdoba province; *Tigriagrion aurantinigrum* Calvert for Corrientes province; and *Acanthagrion minutum* Leonard and *Telebasis willinki* Fraser for Misiones province.

**Keywords:** dry forest, Zygoptera, Anisoptera, dragonfly diversity, Chaco, Campos y Malezales, Córdoba, Corrientes, Formosa, Misiones, Santiago, Salta, Tucumán, new provincial records.

### Introduction

According to Lozano et al. (2020), there are significant gaps in our knowledge of Odonata diversity in Argentina. To address this, we conducted fieldwork in previously unexplored areas of the Chaco dry forests and nearby subtropical savannas in five provinces (Chaco, Formosa, Santiago, Salta, and Tucumán) during 2021 and 2022.

The Gran Chaco, which covers over 1,100,000 km<sup>2</sup> in Northern Argentina, Bolivia, Brazil, and Paraguay, is one of the most threatened ecosystems in the Neotropical region (Kuemerle et al. 2017). The primary threat is deforestation, with land being cleared for soybean monoculture and livestock farming (Gasparri et al. 2015). Although Argentina holds

60% of the Chaco's surface, natural protected areas are scarce in this ecoregion. Additionally, while the major groups of vertebrates have some endemic species, they are under-represented in protected areas (Nori et al., 2016). Invertebrates are even less studied.

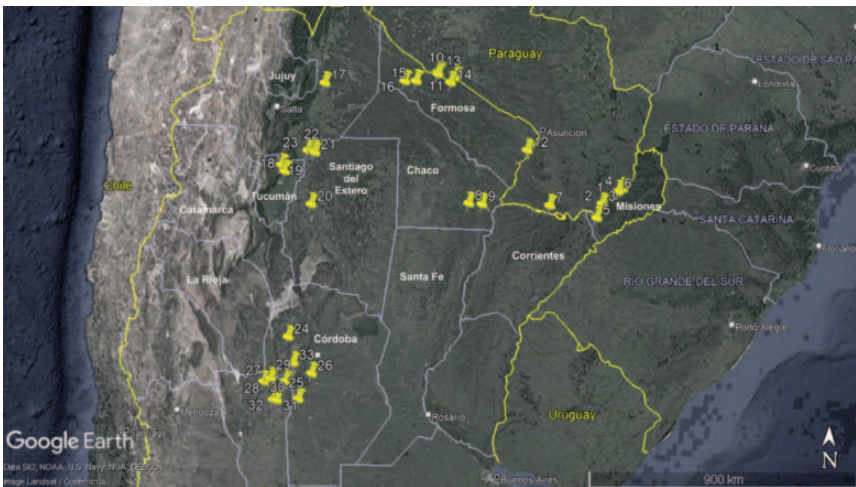
The Chaco dry forests have limited river systems, but several significant wetlands exist, most of which experience large fluctuations in size over time. Aquatic vertebrates such as fishes, amphibians, and reptiles are better known than aquatic macroinvertebrates, which are less studied. Only one study has investigated the Odonata of the area, revealing significant diversity (von Ellenrieder 2010). That work reported 88 species from 93 localities, with nearly half of the species larvae still undescribed.

Our project aims to increase knowledge of the Odonata in the Chaco ecoregion and neighboring areas by expanding the collection and adult-larva associations of these insects.

## Material and Methods

### Identification

The material was identified using keys to adults at the generic level in a first step (Garrison et al. 2006; 2010) and then using other scientific literature to the species level (e.g. Belle 1988, 1992; Borror 1942, Garrison 1994; Garrison 2006, 2009; Lencioni 2005, 2017; Leonard 1977; von Ellenrieder & Garrison 2007). All the material is housed in the Odonate collection of the Instituto de Biodiversidad Neotropical (Tucumán, Argentina). We visited 26 sites in the Chaco ecoregion and 7 sites in Campos y Malezales ecoregion (Map 1) in the following provinces of Argentina: Misiones, Corrientes, Chaco, Salta, Tucumán, Santiago del Estero, San Luis and Córdoba. When specimens are not mentioned under each species section, the record is from observed material only.



**Map 1. Northern Argentina with visited localities. See reference number in the text. Image from Google Earth Pro.**

## Study sites

Geographic coordinates - given in decimal degree coordinates with latitude and longitude - are used to accurately describe the location of a site.

### Misiones, Corrientes and Chaco provinces:

Misiones province belongs almost entirely to the Paranaense forest ecoregion; nevertheless, we visited small patches of savanna-like formations, an intermediate ecotype between the humid paranaense forests and the drier Chaco forests. These patches have been recently classified in a separate and unique ecoregion: "Campos y Malezales" (Matteucci 2012). Its odonate diversity was partially known by a recent work (Schroder et al. 2021). Collecting was done in five localities at Campos y Malezales (localities 1 to 4 and 7 below), two localities in Parana forest (localities 5 and 6) and two localities from Chaco ecoregion (loc. 8 and 9 below), in December 2021 by Carlos Molineri & Gabriela Fontanarrosa.

**Loc. 1-3 (Fig. 1):** Misiones, Campo San Juan, -27.37958, -55.64327. Three sites close to each other were sampled in Campo San Juan: 1) a small artificial pond, 2) the coast of the large Paraná river (Argentina-Paraguay border) and 3) a small forest stream.

**Loc. 4 and 6:** two small rocky streams flowing through Paraná forest were sampled in Misiones: 4) Capioví (-26.92342, -55.05961), and 6) Tabay (-26.99937, -55.17852).

**Loc. 5:** Pindapoy Grande (-27.47234, -55.80609). Lentic habitat.



**Fig. 1.** Paraná river in Campo San Juan, Misiones province (photograph by G. Fontanarrosa).

**Loc. 7:** Corrientes, Santa Lucia stream, -27.51318, -57.23370, 70 m. Small sandy stream in a grassland cultivated area.

**Loc. 8 and 9 (Fig. 2):** Chaco, Tapenagá wetlands (-27.56315, -59.65615, 74 m.a.s.l.), and Palometa stream (-27.55830, -59.29353, 74 m.a.s.l.).



**Figure 2. Tapenagá wetlands, Chaco province (photograph by G. Fontanarrosa).**

### **Formosa and Salta provinces:**

We visited eight localities (Loc. 10-17 below) previously unknown for Odonata in the Chaco ecoregion, mainly in Formosa province from March 15th to March 21st 2022 by Carlos Molineri, Federico Lozano & Gabriela Fontanarrosa.

**Loc. 10 (Fig. 3):** Formosa, Bañado La Estrella, Fortín La Soledad; -24.144715, -60.687155; 143 m, 15.iii.2022.

**Loc. 11:** Formosa, Bañado La Estrella, Riacho "El Escondido" (8 km W de Fortín La Soledad), -24.087442, -60.691436; 145 m; 16.iii.2022.

**Loc. 12a (Figs. 4-5):** Formosa, Río Pilagá (desembocadura en el R. Paraguay), 10 km S de Mojón de Fierro; -26.079602, -57.985996; 63 m.a.s.l.; 17-18.iii.2022.

**Loc. 12b:** Formosa, riacho Pilagá cruce RP 95; -25.225196, -59.716089; 102 m.a.s.l.; 17.iii.2022.

**Loc. 13:** Formosa, Río Pilcomayo y RN86, ca. Posta Cambio Salazar; -24.218023, -60.18146; 135 m.a.s.l.; 19.iii.2022.

**Loc. 14:** Formosa, Bañado La Estrella, Vertedero sobre RP28; -24.36577, -60.312091; 131 m.a.s.l.; 19.iii.2022.

**Loc. 15:** Formosa, Laguna Yema y RP37; -24.347219, -61.314959; 156 m.a.s.l.; 20.iii.2022.



**Figure 3.** La Estrella wetlands, Fortin Soledad, Formosa province (photograph by G. Fontanarrosa).



**Figure 4.** Pilagas stream, Formosa province (photograph by Federico Lozano).



**Figure 5. Mouth of Pilagas stream, Formosa province (photograph by Federico Lozano).**



**Figure 6. Bermejo river, Sumayen, Formosa province (photograph by Federico Lozano).**



**Loc. 16** (Fig. 6): Formosa, ca. Sumayen, Arroyo Teuquito; -24.358281, -61.648425; 168 m a.s.l.; 20.iii.2022.

**Loc. 17:** Salta, Río Dorado, Apolinario Saravia; -24.41868, -63.990433; 358 m a.s.l.; 21.iii.2022.

**Tucumán and Santiago del Estero provinces:**

**Loc. 18:** Tucumán, Las Talitas, Lagunas en ripiera río Salí; -26.781291, -65.161183; 400 m. Artificial ponds in an area of sand extraction were sampled on different dates, the last one on April 2022, by Carlos Molineri & José Rodríguez.

**Loc. 19:** Tucumán, Río Tapia; -26.610453, -65.262803; 668 m.a.s.l., 19.xii.2021, Molineri & Rodríguez.

**Loc. 20 (Fig. 7):** Santiago del Estero, Río Dulce en dique Los Quiroga; -27.66035, -64.36313; 200 m; 4.iv.2022. A sandy river, previously not assessed for Odonata diversity, was sampled in the Chaco dry forest ecoregion by Carlos Molineri, José Rodríguez & Marta Leiva. Due to strong winds few adults of Odonata were observed, so collecting focused on larvae.

**Loc. 21-23 (Figs. 8-9):** a wetland formed by the Urueña river was sampled in 3 different points during October 2022 by Carlos Molineri, José Rodríguez & Gabriela Fontanarrosa on 23-24.x.2022. Loc. 21: Santiago del Estero, Urueña river between Pozo Betbeder and Nueva Esperanza, -26.285909, -64.259477, 200 m.a.s.l.; Loc. 22: Urueña river, near Nueva Esperanza town, -26.234482, -64.302758; Loc. 23: Urueña river, El Remate, -26.233846, -64.469907.



**Figure 7.** Dulce river, Los Quiroga dam, Santiago del Estero province (photograph by José Rodríguez).



Figure 8. Urueña river, Santiago del Estero province (loc. 21) (photograph by José Rodríguez).



Figure 9. Urueña river, Santiago del Estero province (loc. 23) (photograph by José Rodríguez).

### Córdoba and San Luis:

**Loc. 24 (Fig. 10):** Córdoba, San Carlos Minas, río Salsacate; -31.18426, -65.10334; 9.xi.2022; Molineri & Emmerich. Sandy stream, weather conditions were not favorable for collecting adult Odonata.

**Loc. 25 (Fig. 11):** Córdoba, Arroyo Los Molles, Las Albahacas; -32.86083, -64.82444; 760 m.a.s.l.; 26.ii.2021; Márquez col.



**Figure 10.** Salsacate river, Córdoba province (photograph by C. Molineri).



**Figure 11.** Los Molles stream, Córdoba province (photograph by Javier Márquez)..

**Loc. 26 (Fig. 12):** Córdoba, Río Tercero, Segunda Usina, Embalse; -32.16278, -64.37861; 463 m.a.s.l.; 03.iii.2022; Márquez col.

**Loc. 27 (Fig. 13):** San Luis, Río San Vicente, Quebrada de San Vicente; -32.30806, -65.69194; 667 m.a.s.l.; 29.i.2022; Márquez col.

**Loc. 28 (Fig. 14):** San Luis, Río Quines, San Martín; -32.42056, -65.73944; 1001 m a.s.l.; 29.i.2022; Márquez col.



**Figure 12. Tercero river, Córdoba province (photograph by Javier Márquez).**



**Figure 13. San Vicente stream, Córdoba province (photograph by Javier Márquez).**



**Figure 14. Quines river, San Luis province (photograph by Javier Márquez).**



**Figure 15. Santa Rosa river, San Luis province (photograph by Javier Márquez).**

**Loc. 29 (Fig. 15):** San Luis, Río Santa Rosa, Santa Rosa de Conlara; -32.37806, -65.22250; 601 m.a.s.l., 22.ii.2022; Márquez col.

**Loc. 30 (Fig. 16):** San Luis, Río Lujan, Lujan; -32.39361, -65,91500; 647 m a.s.l.; 13.iii.2022; Márquez col.

**Loc. 31:** San Luis, Río Conlara;-32.89488, -65.51390; 865 m a.s.l.; 3.i.2023; Márquez col.

**Loc. 32:** San Luis, Río Conlara, Paso Grande, -32.88222, -65.63000, 961 m a.s.l., 3-i-2023, J. Márquez col.

**Loc. 33:** Córdoba, Las Rabonas, Paraíso Escondido, Arroyo sin nombre; -31.87939, -64.95833; 1122 m a.s.l., 9-15.i.2022 and 15.i.2023, F. Lozano col.



**Figure 16.** Lujan river, San Luis province (photograph by Javier Márquez).

## Results

We present here new geographical records for 84 species, including 13 new provincial records: *Orthemis aequilibris* Calvert, *Brachymesia furcata* (Hagen, 1861), and *Neoneura confundens* Wasscher & van't Bosch for Formosa province; *Rhionaeschna planaltica* (Calvert), *Erythemis plebeja* (Burmeister), *Erythrodiplax nigricans* (Rambur, 1842) and *Progomphus aberrans* Belle for San Luis province; *Planiplax erythroptya* (Karsch 1891), *Homeoura chelifera* (Selys, 1876) and *Oxyagrion brevistigma* Selys, 1876 for Córdoba province; *Tigriagrion aurantinigrum* Calvert for Corrientes province; and *Acanthagrion minutum* Leonard and *Telebasis willinki* Fraser for Misiones province.

We also present new species records for Chaco ecoregion (*Progomphus aberrans*, *P. kimminsi*, *Orthemis aequilibris*, *Planiplax erythropyga*, *Neoneura confundens*, *Oxyagrion brevistigma*), and for Campos y Malezales ecoregion (*Progomphus basistictus*, *Erythrodiplax unimaculata*, *Macrothemis inacuta*, *Micrathyria pseudeximia*, *Tigriagrion aurantincum*).

We reared 14 species from larva to adult: 1 ♀ *Coryphaeschna adnexa* (locality 10), 3 ♂♂ *Tauriphila risi* (loc. 15), 1 ♂ *Erythemis plebeja* (molt not completed, loc. 10), 1 ♂ *Erythemis plebeja* (loc. 15); 4 ♂♂ and 3 ♀♀ of *Erythrodiplax* spp (loc. 20), 2 ♂♂ of *Progomphus kimminsi* (loc. 20), 3 ♀♀ of *Progomphus aberrans* (loc. 24), 3 ♀♀ *Progomphus complicatus* (loc. 19), 1 ♂ and 1 ♀ *Progomphus phyllochromus* (loc. 19), 2 ♀♀ of *Macrothemis imitans* (loc. 24), 3 ♂♂ and 2 ♀♀ *Orthemis discolor* (loc. 2), 2 ♂♂ *Ischnura fluviatilis* (locality 13), 1 ♀ *Ischnura fluviatilis* (loc. 15), and 1 ♂ of *Telebasis willinki* (loc. 21).

## Species list

### Aeshnidae

*Castoraeschna decurvata* Dunkle & Cook, 1984 (Fig. 17)

Localities: 25, 26, 27, 28, 29 and 30.

Specimens: 1 ♂ from each locality, 1 ♀ (loc. 29).

*Coryphaeschna adnexa* (Hagen, 1861)

Locality: 10.

Specimens: 1 ♀ reared from larva, molt not completed.

*Coryphaeschna perrensi* (McLachlan, 1887) (Fig. 18)

Locality: 18.

Specimens: 1 ♂ (loc. 18).

*Rhionaeschna absoluta* (Calvert, 1952) (Fig. 19)

Localities: 27, 28, 29 and 30.

Specimens: 1 ♂ (loc. 25), 1 ♂ (loc. 28), 1 ♂ (loc. 30).

*Rhionaeschna bonariensis* (Rambur, 1842) (Fig. 20)

Localities: 10, 11, 12a, 12b, 15, 26.

Specimens: 1 ♀ (loc. 10), 2 ♂♂ (loc. 12b), 7 ♂♂ and 1 ♀ (loc. 15), 2 ♀♀ (loc. 26).

*Rhionaeschna pallipes* (Fraser, 1947) (Fig. 21)

Localities: 28.

Specimens: 1 ♀.

*Rhionaeschna planaltica* (Calvert, 1952) (Fig. 22)

Localities: 28. **New record for San Luis Province.**

Specimens: none collected, observed and photographed (Fig. 22).

### Gomphidae

*Aphylla distinguenda* Campion (Fig. 23)

Locality: 12a.

Specimens: 1 ♂ and 1 ♀.

Figure 17. *Castoraeschna decurvata* female (loc. 29) (photograph by Javier Márquez).



Figure 18. *Coryphaeschna perrensi* male (loc. 18) (photograph by Carlos Molineri).







Figure 19. *Rhionaeschna absoluta* female (loc. 30) (photograph by Javier Márquez).



Figure 20. *Rhionaeschna bonariensis* male (loc. 15) (photograph by Federico Lozano).

*Phyllocycla argentina* (Hagen in Selys, 1878) (Fig. 24)

Locality: 28.

Specimens: observed.

*Phyllocycla viridipleuris* (Calvert, 1909)

Locality: 7.

Specimens: 1 ♂.

*Progomphus aberrans* Belle, 1973 (Fig. 25)

Localities: 7, 24, 31. **Larval stage previously unknown. New record for San Luis province. New record for Chaco Ecoregion.**

Specimens: 1 ♂ adult (loc. 7); 3 ♀ adults, reared from larvae (loc. 24), 1 ♂ adult and larval exuvia (loc.31).

*Progomphus basistictus* Ris, 1911

Locality: 3. **New record for Campos y Malezales Ecoregion.**

Specimens: 1 ♂.

**Figure 21.** *Rhionaeschna pallipes* male (loc. 28) (photograph by Javier Márquez).



**Figure 22.** *Rhionaeschna planaltica* male (loc. 28) (photograph by Javier Márquez).

*Progompus complicatus* Selys, 1854 (Fig. 25)

Locality: 19.

Specimens: 3 ♀ adults reared, with larval exuviae.

*Progompus joergenseni* Ris, 1908 (Fig. 26)

Locality: 30.

Specimens: observed, not collected.



Figure 23. *Aphylla distinguenda* male (loc. 12) (photograph by Federico Lozano).



Figure 24. *Phyllocycla cf. argentina* male (loc. 15) (photograph by Federico Lozano).

*Progomphus kimminsi* Belle, 1973 (Fig. 27)

Locality: 20. **New record for Chaco Ecoregion. Larval stage previously unknown.**

Specimens: 2 ♂♂ reared from larvae, molt not completed.

*Progomphus phyllochromus* Ris, 1918

Locality: 19.

Specimens: 1 ♂ and 1 ♀ adults reared from larvae.

Figure 25. *Progomphus aberrans* female reared from larva (loc. 24) (photograph by C. Molineri).



Figure 26. *Progomphus joergenseni* male (loc. 30) (photograph by Javier Márquez).



Figure 27. *Progomphus kimminsi* larva (loc. 20) (photograph by C. Molineri).

## Libellulidae

*Brachymesia furcata* (Hagen, 1861) (Fig. 28)

Localities: 12a, 12b, 15. **New record for Formosa province.**

Specimens: 2 ♂♂ (loc. 12a), 1 ♂ (loc. 12b), 1 ♂ (loc. 15).

*Brachymesia herbida* (Gundlach, 1889) (Fig. 29)

Localities: 10, 11, 12a, 15.

Specimens: 4 ♂♂ (loc. 10), 4 ♂♂ (loc. 11), 2 ♂♂ (loc. 12a), 4 ♂♂ and 2 ♀♀ (loc. 15).

*Dasythemis mincki clara* Ris, 1908 (Fig. 30)

Locality: 25.

Specimens: observed, not collected.



Figure 30. *Dasythemis mincki clara* male (loc. 25) (photograph by Javier Márquez).

*Diastatops intensa* Montgomery, 1940 (Fig. 31)

Localities: 2, 10, 11, 12a.

Specimens: Loc. 2 (3 ♂ and 2 ♀ adults); localities 10-12a (not collected).

*Erythemis attala* (Selys in Sagra, 1857)

Localities: 12a, 12b, 15, 17, 18.

Specimens: 1 ♂ (loc. 12a), 1 ♀ (loc. 12b), 1 ♂ (loc. 17), 1 ♂ (loc. 18).

*Erythemis peruviana* (Rambur, 1842) (Fig. 32)

Locality: 12a.

Specimens: 1 ♂.

*Erythemis plebeja* (Burmeister, 1839) (Fig. 33)

Localities: 10, 11, 12a, 15, 16, 26 and 30. **New record for San Luis Province.**

Specimens: 1 ♂ (loc. 10), 4 ♂♂ (loc. 11), 1 ♂ (loc. 15), 1 ♂ and 1 ♀ (loc. 16), 1 ♂ (loc. 30).

*Erythemis vesiculosa* (Fabricius, 1775) (Fig. 34)

Localities: 10, 11, 12a, 12b, 15, 18.

Specimens: 3 ♂♂ (loc. 10), 1 ♂ (at each loc. 12a, 12b, 18), 3 ♂♂ (loc. 15), 5 ♂♂ (loc. 11).

Figure 28. *Brachymesia furcata* male (loc. 15) (photograph by Carlos Molineri).



Figure 29. *Brachymesia herbida* male (loc. 10) (photograph by Federico Lozano).





Figure 31. *Diastatops intensa* male (loc. 12) (photograph by Federico Lozano).



Figure 32. *Erythemis peruviana* male (loc. 12) (photograph by Federico Lozano).



Figure 33. *Erythemis plebeja* male (loc. 16) (photograph by Federico Lozano).

Figure 34. *Erythemis vesiculosa* male (loc. 12) (photograph by Federico Lozano).



Figure 35. *Erythrodiplax atroterminata* male (loc. 25) (photograph by Javier Márquez).



Figure 36. *Erythrodiplax media* male (loc. 15) (photograph by Federico Lozano).







Figure 37. *Erythrodiplax nigricans* male (loc. 32) (photograph by Javier Márquez).

*Erythrodiplax atroterminata* Ris, 1911 (Fig. 35)

Localities: 25, 26, 27, 28, 29 and 30.

Specimens: 1 ♀ (loc. 28).

*Erythrodiplax corallina* (Brauer, 1865)

Localities: 2, 11, 18, 27 and 29.

Specimens: 1 ♂ (loc. 2), 1 ♂ (loc. 11), 1 ♂ (loc. 18).

*Erythrodiplax fusca* (Rambur, 1842)

Locality: 17.

Specimens: 2 ♂♂.

*Erythrodiplax media* Borrer, 1942 (Fig. 36)

Localities: 2, 12b, 17.

Specimens: 1 ♂ adult (loc. 2), 1 ♂ (loc. 12b), 2 ♂♂ (loc. 17).

*Erythrodiplax nigricans* (Rambur, 1842) (Fig. 37)

Localities: 7, 8, 16, 32. **New record for San Luis.**

Specimens 1 ♂ and ♀ (loc. 7), 1 ♂ and 1 ♀ (loc. 8), 1 ♀ (loc. 16), 1 teneral ♂ (loc. 32).

*Erythrodiplax ochracea* (Burmeister, 1839) (Fig. 38)

Locality: 11.

Specimens: 2 ♂♂.

*Erythrodiplax paraguayensis* (Förster, 1905)

Localities: 7, 16.

Specimens 1 ♀ each locality.

*Erythrodiplax umbrata* (Linnaeus, 1758) (Fig. 39)

Locality: 11, 12a, 16.

Specimens: 1 ♂ each locality.

Figure 38. *Erythrodiplax ochracea* male (loc. 11) (photograph by Federico Lozano).



Figure 39. *Erythrodiplax umbrata* male (loc. 12) (photograph by Federico Lozano).



Figure 40. *Macrothemis imitans* male (loc. 25) (photograph by Javier Márquez).



Figure 41. *Macrothemis in-acute* male (loc. 12) (photograph by Federico Lozano).



Figure 42. *Miathyria marcella* male (loc. 15) (photograph by Federico Lozano).



Figure 43. *Micrathyria hesperis* male (loc. 10) (photograph by Federico Lozano).

Figure 44. *Oligoclada laetitia* male (loc. 15) (photograph by Federico Lozano).



Figure 45. *Orthemis aequilibris* male (loc. 11) (photograph by Federico Lozano).



Figure 46. *Perithemis tenera* male (loc. 10) (photograph by Federico Lozano).



*Erythrodiplax unimaculata* (De Geer, 1773)

Locality: 2. **New record for Campos y Malezales Ecoregion.**

Specimens: 1 ♂ adult.

*Macrothemis imitans* Karsch, 1890 (Fig. 40)

Localities: 18, 25, 27, 28 and 30.

Specimens: 4 ♂♂ (loc. 18), 2 ♂♂ (loc. 28).

*Macrothemis inacuta* Calvert, 1898 (Fig. 41)

Localities: 7, 11, 12a. **New record for Campos y Malezales Ecoregion.**

Specimens: 4 ♂♂ (loc. 7), 1 ♂ (loc. 11), 2 ♂♂ (loc. 12a).

*Miathyria marcella* (Selys in Sagra, 1857) (Fig. 42)

Localities: 5, 7, 8, 10, 11, 12a, 12b, 13, 14, 15.

Specimens: 3 ♂♂ and 2 ♀♀ (loc. 5), 2 ♂♂ (loc. 7), 5 ♂♂ and 3 ♀♀ (loc. 8), 3 ♂♂ and 7 ♀♀ (loc. 10), 7 ♂♂ and 3 ♀♀ (loc. 11), 4 ♂♂ and 1 ♀ (loc. 12a), 1 ♂ (loc. 12b), 5 ♂♂ and 4 ♀♀ (loc. 14), 5 ♂♂ and 1 ♀ (loc. 15).

*Micrathyria hesperis* Ris, 1911 (Fig. 43)

Localities: 10, 11, 12b, 15.

Specimens: 1 ♂ and 1 ♀ (loc. 10), 6 ♂♂ and 3 ♀♀ (loc. 11), 3 ♂♂ (loc. 12b), 7 ♂♂ and 1 ♀ (loc. 15).

*Micrathyria longifasciata* Calvert, 1909

Localities: 8, 11, 12b, 15, 16.

Specimens: 5 ♂♂ (loc. 8), 2 ♂♂ (loc. 11), 2 ♂♂ (loc. 12b), 3 ♂♂ (loc. 15), 6 ♂♂ (loc. 16).

*Micrathyria pseudeximia* Westfall, 1992

Locality: 2. **New record for Campos y Malezales Ecoregion.**

Specimens: 1 ♂.

*Oligoclada laetitia* Ris, 1911 (Fig. 44)

Localities: 2, 12a, 15.

Specimens: 3 ♂ adults (loc. 2), 1 ♂ (loc. 12a).

*Oligoclada rubribasalis* von Ellenrieder & Garrison, 2008

Localities: 12a, 15.

Specimens: 1 ♂ each locality.

*Orthemis aequilibris* Calvert, 1909 (Fig. 45)

Localities: 11. **New record for Formosa province. New record for Chaco Ecoregion.**

Specimens: 1 ♂.

*Orthemis discolor* (Burmeister, 1839)

Locality: 2.

Specimens: 3 ♂♂ and 2 ♀♀ reared from larvae, 2 ♂ adults.

*Orthemis nodiplaga* Karsch, 1891

Localities: 12b, 15, 18, 27 and 29.

Specimens: 2 ♂♂ (loc. 12b), 2 ♂♂ and 1 ♀ (loc. 15).

**Figure 47.** *Planiplax erythropyga* male (loc. 26) (photograph by Javier Márquez).



**Figure 48.** *Sympetrum gilvum* male (loc. 25) (photograph by Javier Márquez).



**Figure 49.** *Tramea darwini* male (loc. 16) (photograph by Federico Lozano).



*Pantala flavescens* (Fabricius, 1798)

Localities: 12a, 15, 18, 28 and 29.

Specimens: 1 ♂ (loc. 12a), 6 ♂♂ and 2 ♀♀ (loc. 15).

*Perithemis icteroptera* (Selys in Sagra, 1857)

Locality: 3.

Specimens: 1 ♂.

*Perithemis lais* (Perty, 1833)

Locality: 2.

Specimens: 1 ♂.

*Perithemis tenera* (Say, 1840) (Fig. 46)

Localities: 2, 8, 10, 11, 12a, 12b, 15, 17, 18, 26, 28, 29 and 30.

Specimens: 1 ♂ (loc. 2), 1 ♂ and 1 ♀ (loc. 8), 3 ♂♂ (loc. 10), 4 ♂♂ (loc. 11), 2 ♂♂ (loc. 12a), 5 ♂♂ (loc. 12b), 4 ♂♂ (loc. 15), 1 ♂ (loc. 17), 1 ♂ (loc. 30).

*Planiplax erythrogya* (Karsch 1891) (Fig. 47)

Locality: 26. **New record for Córdoba province. New record for Chaco Ecoregion.**

Specimens: 2 ♂♂ (6-iii-2019).

*Sympetrum gilvum* (Selys, 1884) (Fig. 48)

Locality: 25.

Specimens: 1 ♂ (loc. 25).

*Tauriphila risi* Martin, 1896

Localities: 13, 15.

Specimens: 1 ♂ (loc. 13), 3 reared ♂♂ (loc. 15).

*Tamea darwini* Kirby, 1889 (Fig. 49)

Localities: 15, 16.

Specimens: 1 ♂ each loc.

*Tamea cophysa* Hagen, 1867

Localities: 14, 20.

Specimens: 1 ♂ (loc. 14), 1 tandem (loc. 20).

## Calopterygidae

*Hetaerina mendezi* Jurzitza, 1982

Locality: 4.

Specimens: 1 ♂ adult.

*Hetaerina rosea* Selys, 1853

Localities: 3, 4, 6, 17, 18, 29.

Specimens: 1 ♂ (loc. 3), 3 ♂♂ (loc. 4), 2 ♂♂ (loc. 6), 6 ♂ adults (loc. 17).

*Mnesarete grisea* (Ris, 1918)

Locality: 17.

Specimens: 7 ♂ adults.

## Coenagrionidae

*Acanthagrion aepiolum* Tennessen, 2004

Locality: 3.

Specimens: 6 ♂ adults.

*Acanthagrion cuyabae* Calvert, 1909

Locality: 2, 12a, 12b.

Specimens: 1 ♂ adult each locality.

*Acanthagrion floridense* Fraser, 1946 (Fig. 48)

Localities: 17, 20, 26, 27 and 29.

Specimens: 39 ♂ and 6 ♀ adults (loc. 17), 2 ♂ ♂ (loc. 20), 10 ♂ ♂ (loc. 26), 2 ♂ ♂ (loc. 27), 4 ♂ ♂ (loc. 29).

**Figure 50. *Acanthagrion floridense* male (loc. 29) (photograph by Javier Márquez).**



*Acanthagrion gracile* (Rambur, 1842)

Locality: 2.

Specimens: 1 ♂.

*Acanthagrion hildegarda* Gloger, 1967

Locality: 12b.

Specimens: 1 ♂.

*Acanthagrion lancea* Selys, 1876

Localities: 2, 7, 11, 12, 12b, 15, 18, 20.

Specimens: 1 ♂ (loc. 2), 1 ♂ (loc. 7), 1 ♂ (loc.11), 1 ♀ adult (loc. 12), 4 ♂ ♂ (loc. 12b), 1 ♂ (loc. 15), 4 ♂ ♂ and 3 ♀ ♀ (loc. 18), 4 ♂ ♂ (loc. 20).

*Acanthagrion minutum* Leonard, 1977 (Fig. 51)

Locality: 2. **New record for Misiones province.**

Specimens: 1 ♂.

*Aeolagrion phillipi* Tennessen, 2009

Locality: 12a, 12b.

Specimens: 2 ♂ ♂ (loc. 12a), 1 ♂ (loc. 12b).





Figure 51. *Acanthagrion minutum* male (loc. 2) (photograph by Carlos Molineri).

*Argentagrion ambiguum* (Ris, 1904)

Locality: 11.

Specimens: 2 ♂♂.

*Argia albistigma* Hagen in Selys, 1865

Locality: 3.

Specimens: 6 ♂♂ and 1 ♀ adults.

*Argia croceipennis* Selys, 1865

Localities: 3, 4, 6.

Specimens: 1 ♂ adult at each locality.

*Argia joergenseni* Ris, 1913 (Fig. 52)

Localities: 18, 20, 25, 26, 27, 28 and 30.

Specimens: 3 ♂♂, 2 ♀♀ (loc. 20), 1 ♂ (loc. 26).

**Figure 52.** *Argia joergenseni* male (loc. 25) (photograph by Javier Márquez).



*Enallagma novaehispaniae* Calvert, 1907

Localities: 17.

Specimens: 12 ♂♂ and 1 ♀ adults.

*Homeoura chelifera* (Selys, 1876) (Fig. 53)

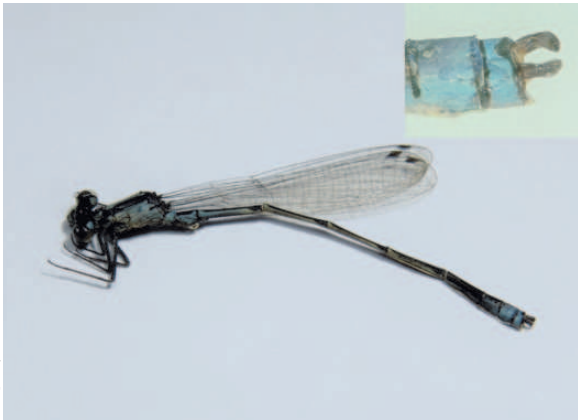
Localities: 10, 11, 12a, 26. New record for Córdoba.

Specimens: 2 ♂♂ (loc. 10), 3 ♂♂ (loc. 11), 3 ♂♂ (loc. 12a), 2 ♂♂ (loc. 26: 6-iii-2019).

*Homeoura lindneri* (Ris, 1928)

Localities: 2, 5.

Specimens: 3 ♂♂ adults (loc. 2), 1 ♂ adult (loc. 5).



**Figure 53.** *Homeoura chelifera* male (loc. 26) (photograph by Javier Márquez).

*Ischnura capreolus* (Hagen, 1861):

Localities: 17, 20.

Specimens: 10 ♂♂ and 2 ♀ adults (loc. 17), 1 tandem (loc. 20).

*Ischnura fluviatilis* Selys, 1876 (Fig. 53)

Localities: 2, 5, 9, 10, 11, 12a, 14, 15, 18, 25, 27, 29 and 30.

Specimens: 1 ♂ and 2 ♀ adults (loc. 2), same (loc. 5), 2 ♀ adults (loc. 9), 15 ♂♂ and 4 ♀♀ (loc. 10), 8 ♂♂ and 14 ♀♀ (loc. 11), 1 ♂ and 3 ♀ adults (loc. 12a), 1 ♂ (loc. 14), 6 ♂♂ and 2 ♀♀ (loc. 15), 2 ♂♂ and 1 tandem (loc. 29), 2 ♂♂ and 1 ♀ (loc. 30).

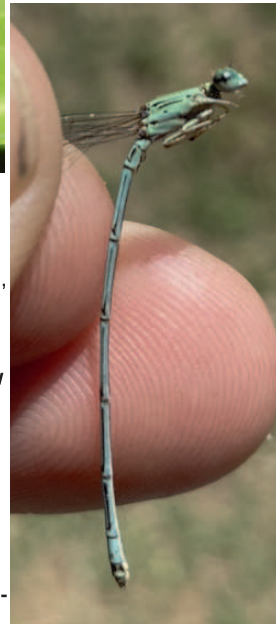
*Neoneura confundens* Wasscher & van't Bosch, 2013 (Fig. 54)

Localities: 16, 17. **New record for Formosa province. New record for Chaco Ecoregion.**

Specimens: 1 tandem (loc. 16), 7 ♂♂ and 5 ♀♀ (loc. 17).



Figure 53. *Ischnura fluviatilis* female (loc. 14) (photograph by Federico Lozano).



*Oxyagrion ablutum* Calvert, 1909 (Fig. 55)

Localities: 18, 25, 27, 28 and 30.

Specimens: 2 ♂♂ (loc. 25), 1 ♂ (loc. 26), 1 ♂ (loc. 28), 1 ♂ (loc. 30).

*Oxyagrion brevistigma* Selys, 1876 (Fig. 56)

Localities: 33. **New record for Córdoba province. New record for Chaco Ecoregion.**

Specimens: 2 ♂♂ and 3 ♀♀ adults.

*Oxyagrion chapadense* Costa, 1978

Localities: 3, 4.

Specimens: 1 ♂ adult at each locality.

Figure 54. *Neoneura confundens* male (loc. 16) (photograph by Federico Lozano).

Figure 55. *Oxyagrion ablutum* male (loc. 25) (photograph by Javier Márquez).



Figure 56. *Oxyagrion brevistigma* male (loc. 33) and detail of ligula in lateral view; bottom right: female mesostigmal plate in dorsal view (photographs by Federico Lozano).

*Oxyagrion rubidum* (Rambur, 1842)

Localities: 25, 26, 27, 28, 29 and 30.

Specimens: 1 ♂ (loc. 26), 1 tandem (loc. 28).

*Peristicta aeneoviridis* Calvert, 1909

Localities: 3, 4.

Specimens: 5 ♂ adults (loc. 3), 1 ♂ adult (loc. 4).

*Telebasis obsoleta* (Selys, 1876)

Locality: 2.

Specimens: 1 ♂.

*Telebasis willinki* Fraser, 1948 (Fig. 57)

Localities: 5, 10, 11, 12b, 14, 15, 16. **New record for Misiones province.**

Specimens: 5 ♂♂ (loc. 5), 1 ♂ (loc. 11), 4 ♂♂ (loc. 12b), 1 ♂ (loc. 14), 1 ♂ (loc. 15), 1 ♂ (loc. 16).



**Figure 57. *Telebasis willinki* male (loc. 14) (photograph by Federico Lozano).**

*Tigriagrion aurantinigrum* Calvert, 1909

Localities: 7. **New record for Corrientes province. New record for Campos y Malesales Ecoregion.**

Specimens: 2 ♂ adults.

**Lestidae**

*Lestes spatula* Fraser, 1946

Locality: 15.

Specimens: 1 ♂.

**Megapodagrionidae**

*Heteragrion aurantiacum* Selys, 1862

Locality: 3.

Specimens: 3 ♂ adults.

**Discussion**

During the course of our study, we visited 26 sites in the Chaco region and 7 sites in other ecoregions, and discovered a large diversity of 84 Odonata species, which covers 29%

of the total Odonata richness known for Argentina (Lozano et al. 2020). Additionally, we successfully reared larvae from 14 species, including two previously unknown species at the larval stage (*Progomphus aberrans* and *P. kimminsi*, Molineri et al. in revision). Previous studies by von Ellenrieder (2010) recorded 88 species in the Chaco ecoregion (4 of them not formally named, treated as probable new species). Lozano et al. (2020) recorded 94 species for the same ecoregion, excluding 12 species cited by von Ellenrieder (2010). Thus, at present 94 (Lozano et al.) + 12 (in von Ellenrieder but not in Lozano et al.) + 6 (this work) = 112 species are known to occur in Chaco ecoregion from Argentina.

Lozano et al. (2020) registered 93 species occurring in Campos y Malezales, Schroder et al. (2021) added 15 more, and with the 5 species reported in the present work, a total of 113 species are recorded in this ecoregion.

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